1. Introduction

A large number of somewhat specific terms and concepts are traditionally used in environmental epidemiology to describe the relationships between environment and health, and to express the various types of risk which might occur. Sadly, many of these terms are often only poorly understood by those who use them, or are used rather loosely. This inevitably raises dangers of misunderstanding. In the context of National Environmental Health Action Plans, where there is a need to communicate concepts of risk to non-specialists, and where major costs may rest on the decisions made, there is clearly a need to minimise such dangers. Before examining some of the more sophisticated techniques for risk assessment, therefore, it is important to clarify some of the basic terms which are used.

2. Incidence and Prevalence

The frequency of health events or outcomes is described in epidemiology by two related but distinct terms: incidence and prevalence.

The prevalence or prevalence rate (P) is a static measure or 'snapshot' of the frequency that prevails at a given moment. It is described by the equation:

\[ P = \frac{A}{N} \]

where:

- \( A \) = number of individuals with attribute or event; and
- \( N \) = total number of individuals in group.

In other words, it is the number of the sick individuals in the examined population at a point of time.
The incidence or incidence rate \( I \) refers to the proportion of members of any fixed group developing an attribute or outcome within a specified time period (e.g., monthly incidence, annual incidence). It is given by the equation:

\[
I = \frac{B}{N \times t}
\]

where:

- \( B \) is the number of individuals who developed the attribute or outcome during the specified time period;
- \( N \) is the total number of individuals in the group (the total number of individuals must be fixed during the examination and new members cannot be added); and
- \( t \) is the time period of the study, in units appropriate for measurement of the incidence (e.g., daily, monthly or annual incidence).

If the members of the group change during the examination (e.g., as part of a follow-up study) the equation is modified to:

\[
I = \frac{B}{\sum (m \times t)}
\]

where:

- \( B \) is as above; and
- \( m \times t \) is the so-called person-duration (e.g., person-month, person-years) – that is the product of the members and their participation-time in the examined group.

Incidence is thus a measure of the frequency with which new cases of the outcome occur over time. As such, it is a useful tool where interest focuses on the cause of the outcome, because causal factors operate prior to the development of the effects they generate. If the group is fixed during the investigation, the incidence is equivalent to the risk of an individual experiencing the specified outcome or the probability that it will occur. If the members of the group change during the examination, it is called a ‘dynamic group’; in this case, strictly speaking, the incidence cannot be called risk, but should be referred to as 'incidence density' (ID). Nevertheless, the term 'risk' is still often loosely used in these situations.

Prevalence is useful for describing the extent or 'burden' of an attribute in a given population. It is therefore of great importance from a public health perspective to determine existing health and disease status.

The incidence and prevalence can be expressed either as a fraction (e.g., \( \frac{11}{200} \)), or as a per cent (e.g., \( 5.5\% \)). If the value of the fraction is very small, it is traditionally multiplied by 1000, to give the probability of the outcome per 1000 individuals.